

Update on Flow Objectives and Flow-Related Activities in the North Coast Region

Item 7

North Coast Regional Water Quality Control
Board Meeting
August 15, 2019
Santa Rosa, CA



Regional Water Board Efforts to Address Flow-Related Water Quality Concerns

Agenda:

- Introduction
- Terminology
- Streamflow monitoring
- Numeric flow objectives
- Narrative flow objective
- Water quality-based flow criteria
- Flow agreements
 - Guest speaker: David Hines, CDFW
- Other efforts to address flow concerns

Acknowledgements

- Dan Schultz, SWRCB Water Rights Cannabis
- Dan Worth, SWRCB Water Rights Instream Flow
- Sarah Nossaman Pierce, California Sea Grant
- David Hines, CDFW Bay/Delta Region Coho Salmon Recovery Coordinator

Terminology

California Water Action Plan

- Governor's Brown's initiative
- Developed by CalEPA, CA Natural Resources Agency, CDFA
- Objectives:
 - more reliable water supplies
 - the restoration of important species and habitat; and
 - a more resilient, sustainably managed water resources system

California Water Plan

- State's water management plan
- Maintained by CA Department of Water Resources
- Updated every 5 years

Terminology

Beneficial Use (basin planning)

- The values and uses of water that are to be protected against water quality degradation

Department of Water Resources

- Manages state water infrastructure
- Water supply planning

Beneficial Use (water rights)

- The purpose for which water is being diverted

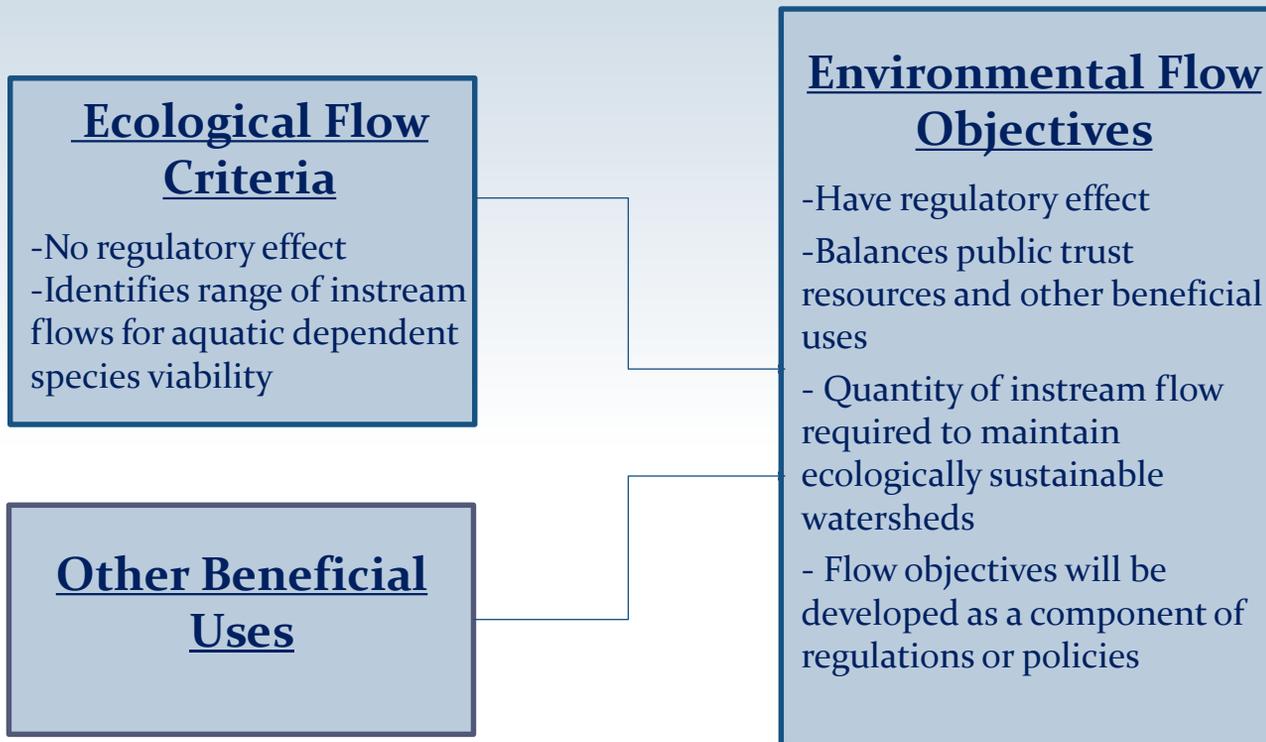
Division of Water Rights

- Division of the SWRCB in charge of allocation of water resources

Water Quantity Authorities

Agency	Planning/ Policy	Implementation/ Permitting	Instream Flow Recommendations
State Water Board	X	X	
Regional Water Boards	X		
Department of Fish and Wildlife		X	X

Terminology



Context

- Droughts, floods, and cannabis... oh my!
 - Regulatory responses
 - Russian River Tributary Emergency Regulations
 - California Water Action Plan
 - Cannabis regulatory programs
 - Climate change
 - Increased frequency of mega floods
 - More severe droughts
- Need tools to address flow-related impacts to water resources

Streamflow Monitoring

Multi-purpose:

- Improve understanding of relationship between flow and water quality
- Gauge effectiveness of regulatory efforts
- Provide model calibration data
- Support California Water Action Plan efforts
- Screen for impacts associated with diversion practices
- Inform cannabis regulatory priorities
- Inform development of flow objectives

Streamflow Monitoring

Watershed	Calibration/ Validation	Effectiveness	Flow-DO	Screening	Local Support	Stage Only
Trinity		X		X	X	
SF Eel	X			X		
Eel				X		
Van Duzen				X		X
Navarro	X		X	X		
Russian			X	X		

Flow Objective Projects (and related efforts)

Navarro River Objectives

- Phase 1 is complete (study plan development)
- Standard instream flow analysis approach, with additional water quality assessment
- Cost, capacity challenges
- Multi-year project

NAVARRO RIVER BASIN
INSTREAM FLOW NEEDS STUDY PLAN



Prepared for:
North Coast Regional Water Quality Control Board

Prepared by:



with:



R2 Resource Consultants, Inc.
15250 NE 95th Street
Redmond, WA 98052

March 2019

Navarro Flow Objectives

Standard Instream Flow Analysis Approach:

- Collect field data at representative locations over a range of flows
- Develop a hydraulic model to estimate habitat attributes as a function of flows
- Characterize the range of suitable values as a function of flows
- Develop a hydrologic model to understand natural flows and support of habitat needs
- Focus: depth, velocity, and cover (hiding place) needs for spawning, rearing, and migration of salmonids

Narrative Flow Objective Development

- Currently developing conceptual approaches
 - Ranking and prioritization
 - Instream requirements vs performance standards ?
- Next steps:
 - Solidify approach and consult with Division of Water Rights
 - Continue developing the “tool box”

California Water Action Plan

Action 4 – Protect and Restore Important Ecosystems

Sub-action: **Enhance Water Flows in Stream Systems Statewide (Page 12 of WAP)**

“The State Water Resources Control Board and the Department of Fish and Wildlife will implement a suite of individual and coordinated administrative efforts to enhance flows statewide in at least five stream systems that support critical habitat for anadromous fish...”



Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., GRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), Swisstopo, Mapbox, OpenStreetMap contributors, and the GIS User Community.

Water Action Plan Overview

- What environmental flows are needed?
 - Assessing existing flow studies and recommendations
 - California Department of Fish and Wildlife is conducting additional flow studies where needed
- State Water Board will consider flow recommendations and other available information
- May result in instream flow agreements, policies, regulations, or other implementation actions

Current WAP Activities

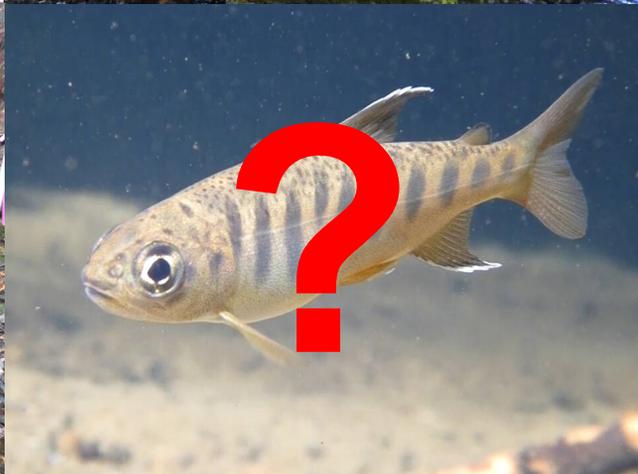
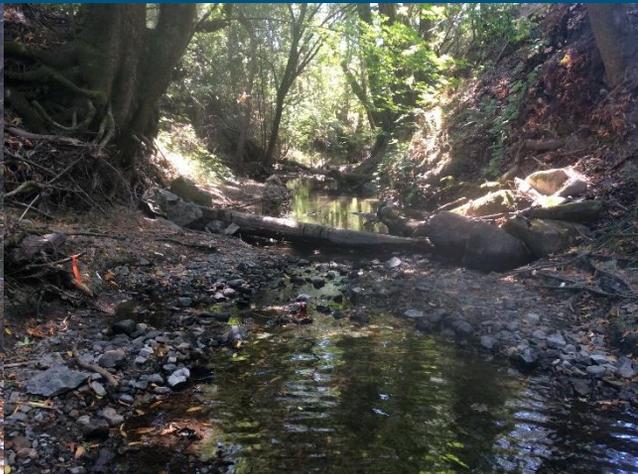
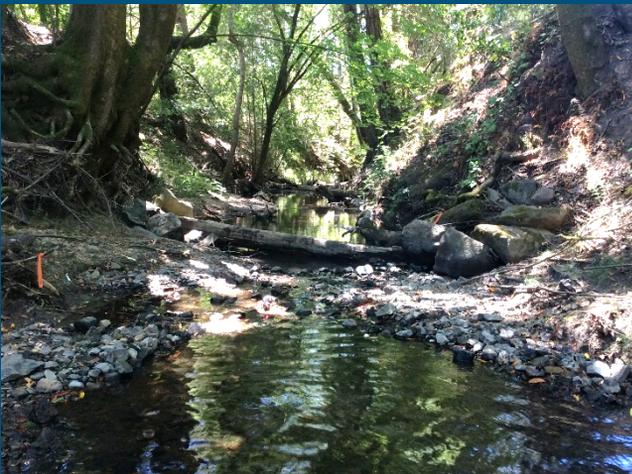
- State Water Board has started the process of developing hydrology models to provide information about water supply, water demand, instream flows, and surface water/groundwater interactions
- California Department of Fish and Wildlife is implementing instream flow studies in South Fork Eel River and Mark West Creek watersheds
- Regional Water Board staff: data collection, review and consultation, and other assistance

Other Flow-Related Activities

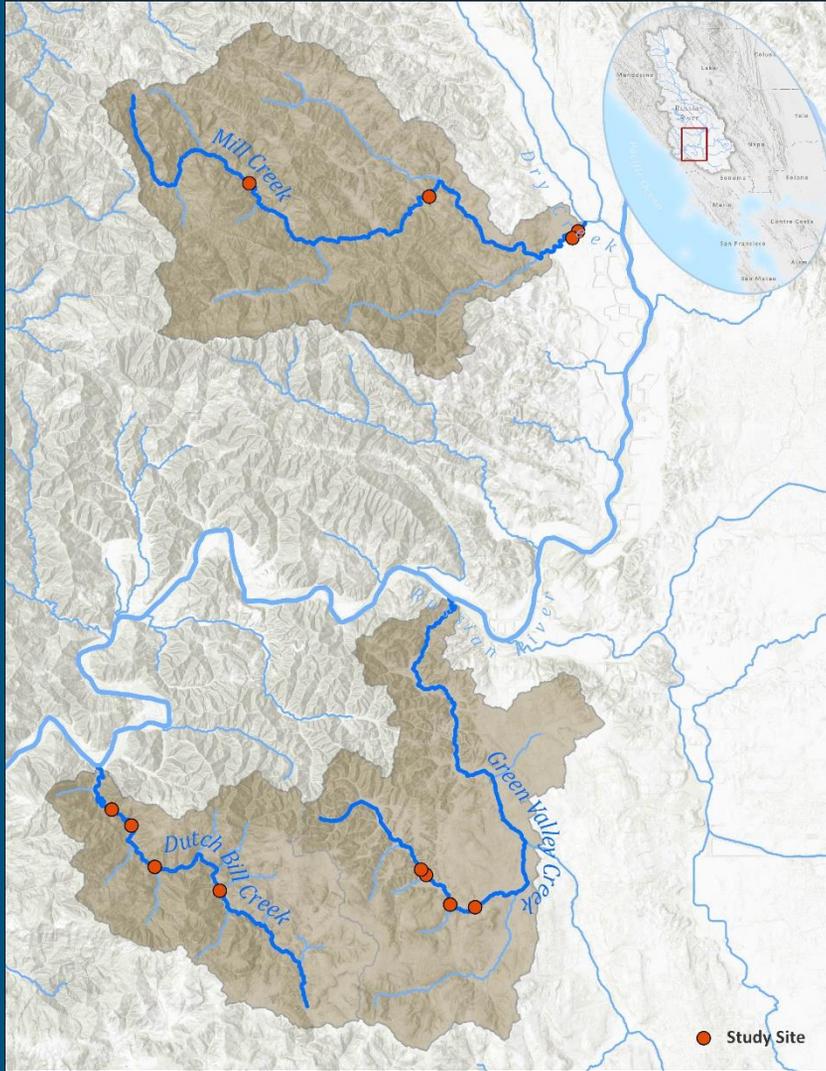
Dynamics that influence dissolved oxygen concentrations in salmonid rearing pools and possible implications for management

Sarah Nossaman Pierce, Mariska Obedzinski, Elizabeth Ruiz,
Andy McClary, and Andrew Bartshire, California Sea Grant
Bryan McFadin and Lance Le, North Coast Regional Water Quality
Control Board





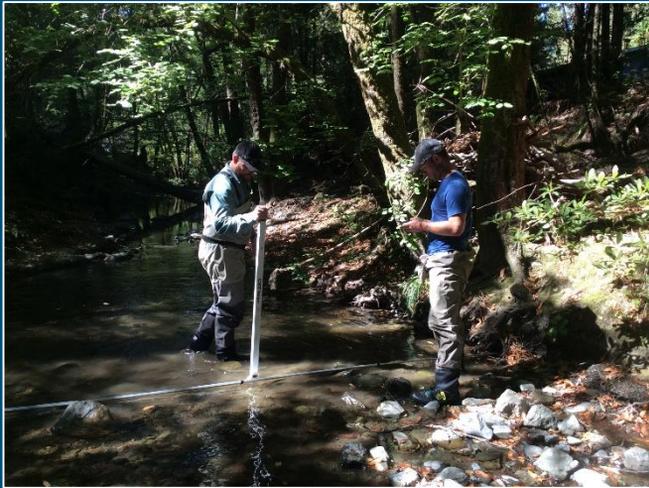
- Oversummer survival of coho salmon positively associated with **D**issolved **O**xygen (Woelfle-Erskine et al. 2017, Obedzinski et al. 2018)
- As flows recede over dry season, DO impairment can threaten over-summering salmonids even in reaches that remain wet
- Is there a readily-measured **indicator** that can help predict DO impairment?
- Pilot study: Do flow-related habitat parameters (e.g., discharge, depth, volume, etc) influence **DO suitability** through the summer dry season?
 - **DO suitability = meets regional objective - daily minimum 6.0 mg/L**



Study sites

- High priority coho rearing streams lower Russian River basin (3rd order)
 - Dutch Bill Creek
 - Green Valley Creek
 - Mill Creek
- 12 sites, spanning range of conditions

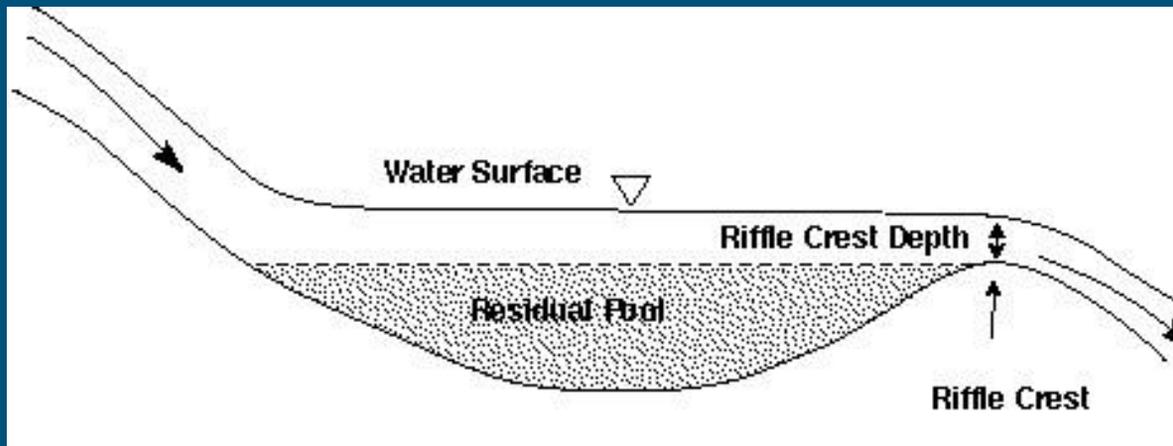




Data collection

- Continuous:
 - Pool DO
 - Water temperature
 - Stage depth
 - Biweekly:
 - Discharge
 - Riffle crest thalweg (RCT) depth
 - Riffle area
 - Pool area/wetted volume
 - Pool max depth
 - Connectivity
 - Streambed geology at site
 - Bedrock, alluvial, or alluvium on bedrock
 - Dominant substrate at RCT
 - Riffle slope
-

Riffle Crest Thalweg



Potential DO predictors

POOL

- Pool
 - ✓ Max depth
 - ✓ Length
 - ✓ Average width
 - ✓ Average depth
 - ✓ Area
 - ✓ Volume

RIFFLE

- Riffle
 - ✓ Riffle crest thalweg depth
 - ✓ Pool tail crest depth
 - ✓ Length
 - ✓ Width
 - ✓ Area
 - ✓ Riffle slope

FLOW

- Discharge

- Temperature
 - ✓ At sample time
 - ✓ Max daily
 - ✓ Average daily
 - ✓ Previous day max
- Study day
 - ✓ # days since started
 - ✓ Sine of day of year
 - ✓ Cosine of day of year

- Site
- Year
- Streambed geology
- Tributary
- Sample number
- RCT dominant substrate
- Disconnection
- Algae cover/color

TEMPERATURE/TIME

CATEGORICAL



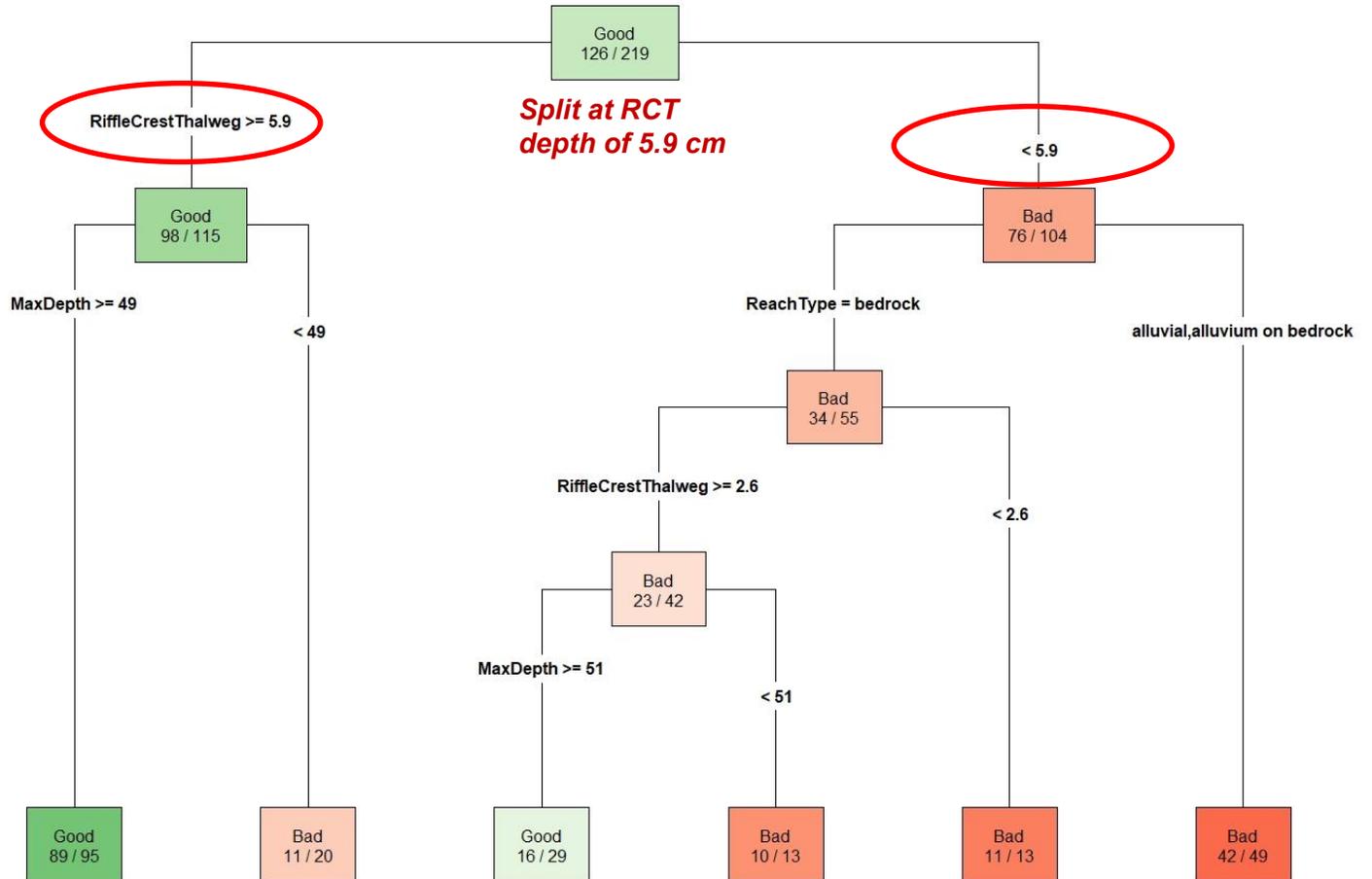
- Determine importance of potential predictors (mixed logistic regression, stepwise regression, random forest models)
- How well did each variable predict whether minimum DO on sample date met objective?
- Identify single most important predictor in each highly-correlated group



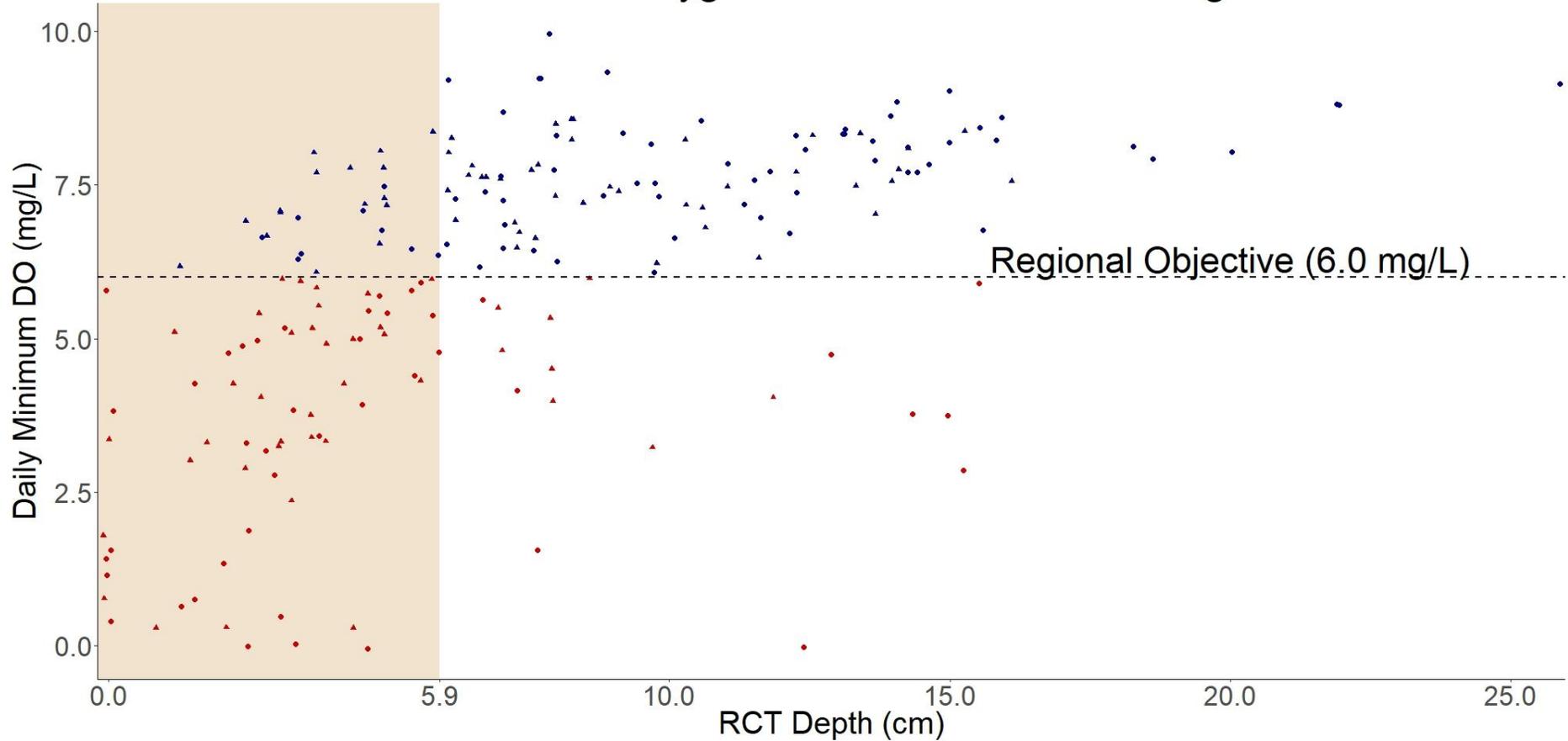
Minimum Daily Dissolved Oxygen Classification Tree

Good = met minimum daily DO objective of 6.0 mg/L

Bad = did not meet objective

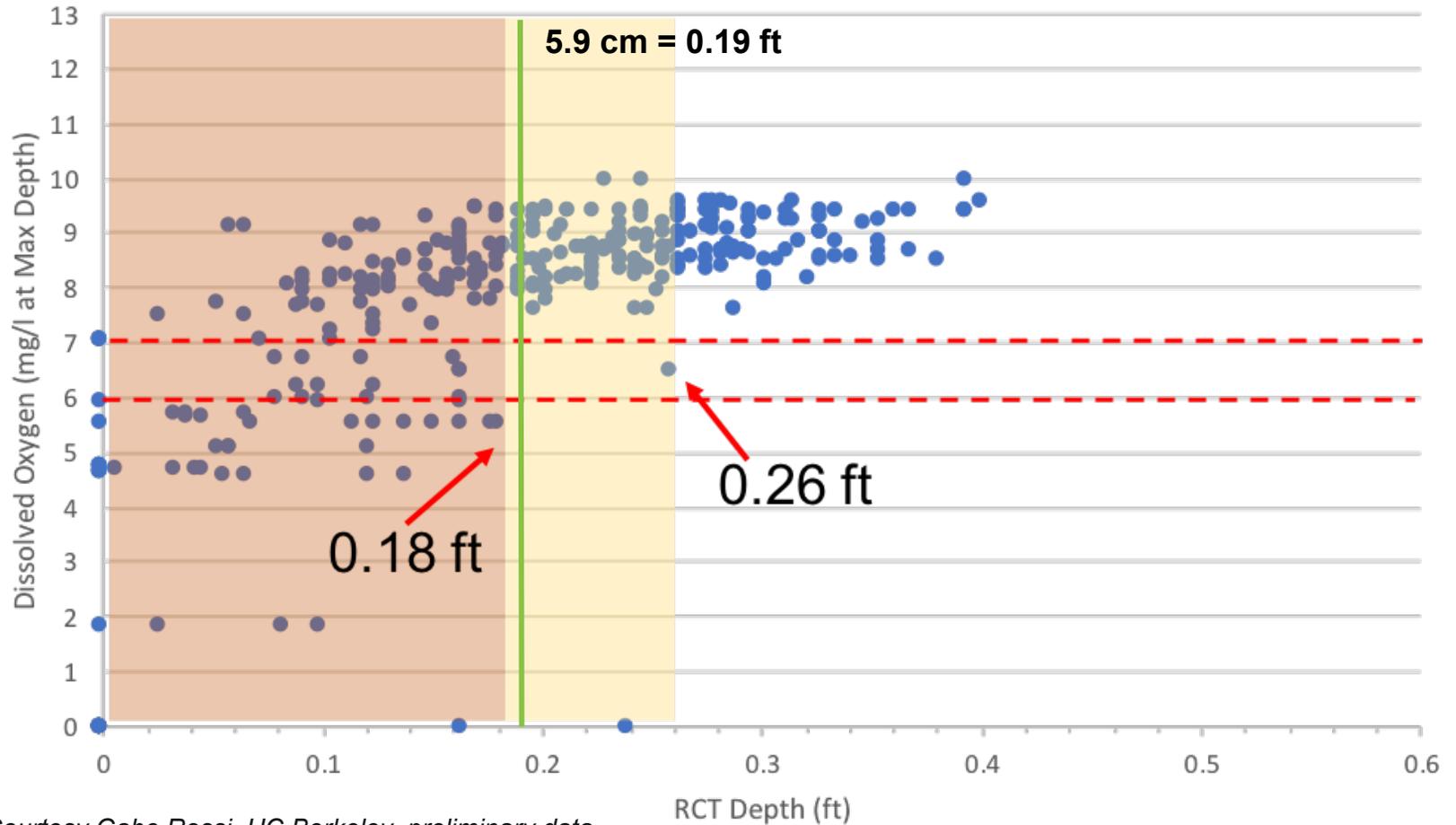


Dissolved Oxygen and Riffle Crest Thalweg



RCT depth of ~6 cm predicted whether DO met objective with 82% overall accuracy

Porter Creek DO vs RCT Depth



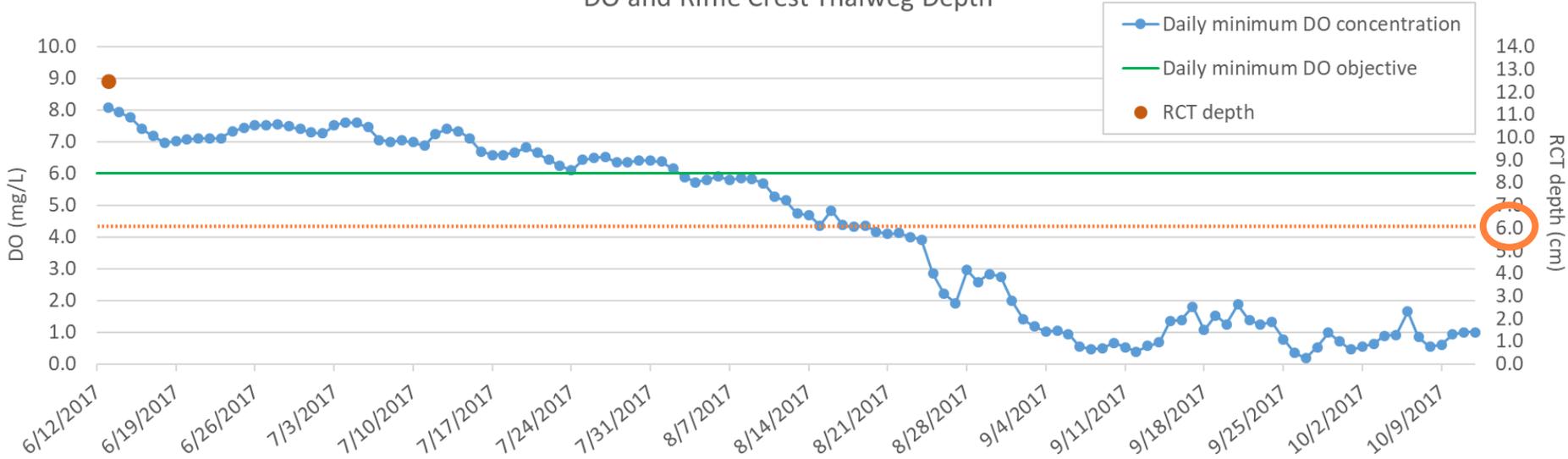
Courtesy Gabe Rossi, UC Berkeley, preliminary data



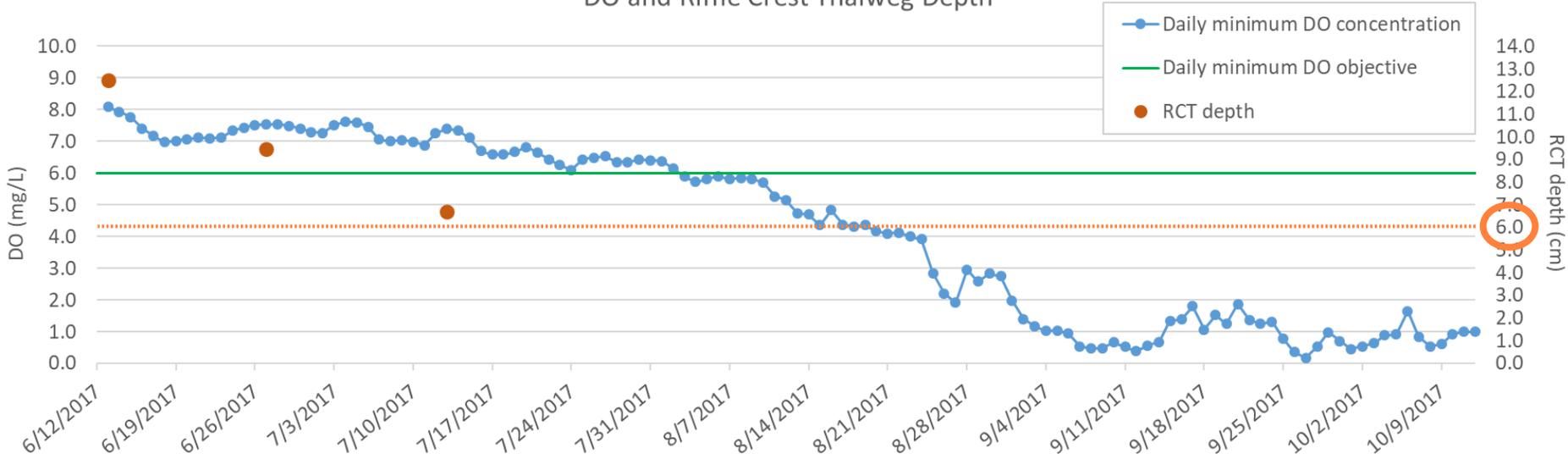
max pool depth

riffle crest thalweg

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth

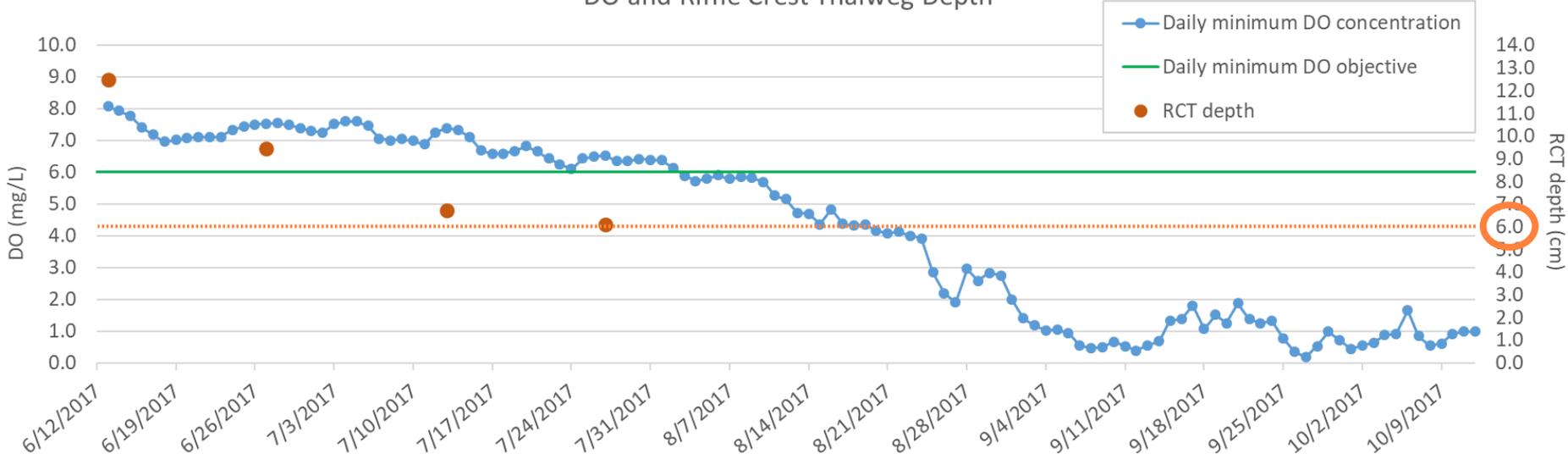


Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth



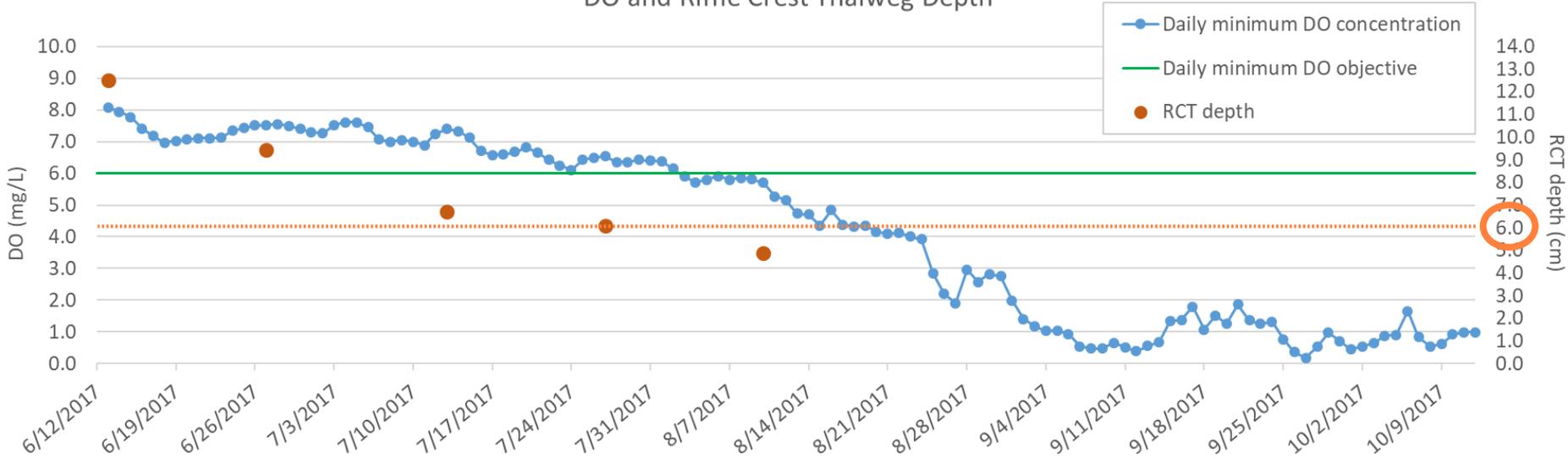
INDULTRIE ⓘ 26°C 29.88InHg PS-MIL-P2 18 JUL 2017 02:10 pm

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth



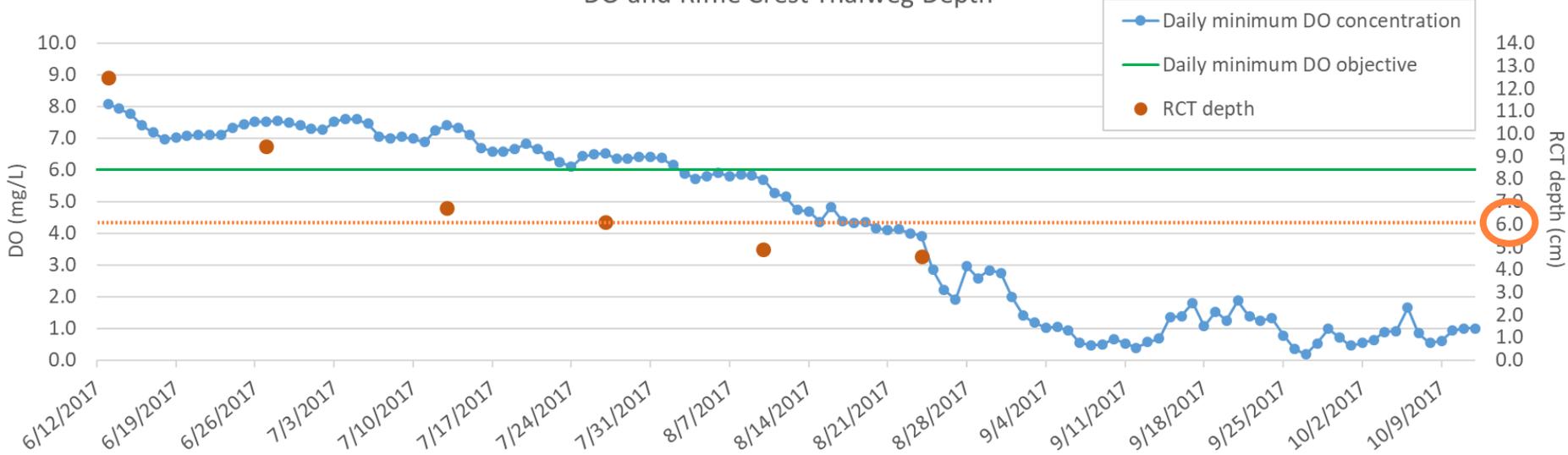
INDUSTRIE 18°C 29.90InHg PS-MIL-P2 27 JUL 2017 10:00 am

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth



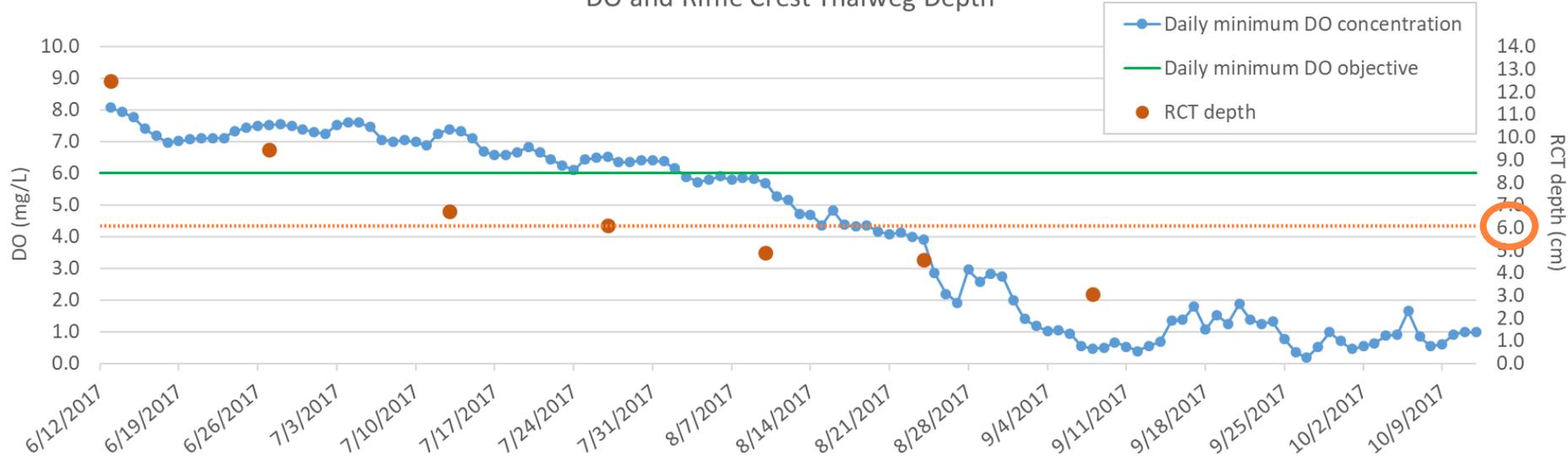
INDULTRIE 16°C 29.88inHg PS-MIL-P2 10 AUG 2017 10:00 am

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth



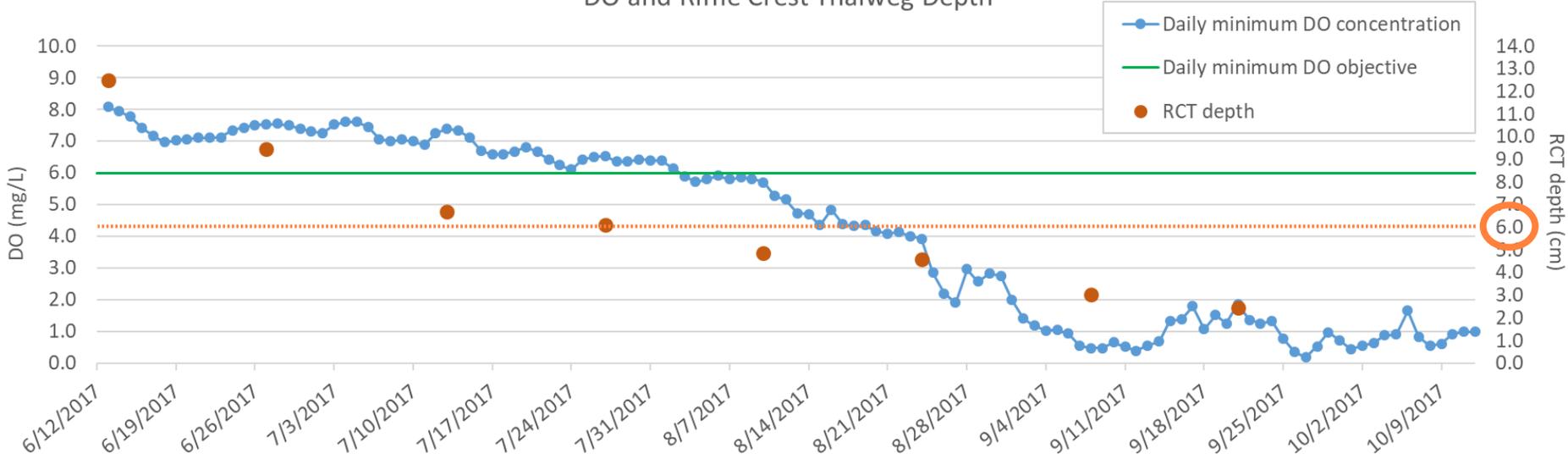
INDULTRIE 18°C 29.81inHg PS-MIL-P2 24 AUG 2017 11:30 am

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth



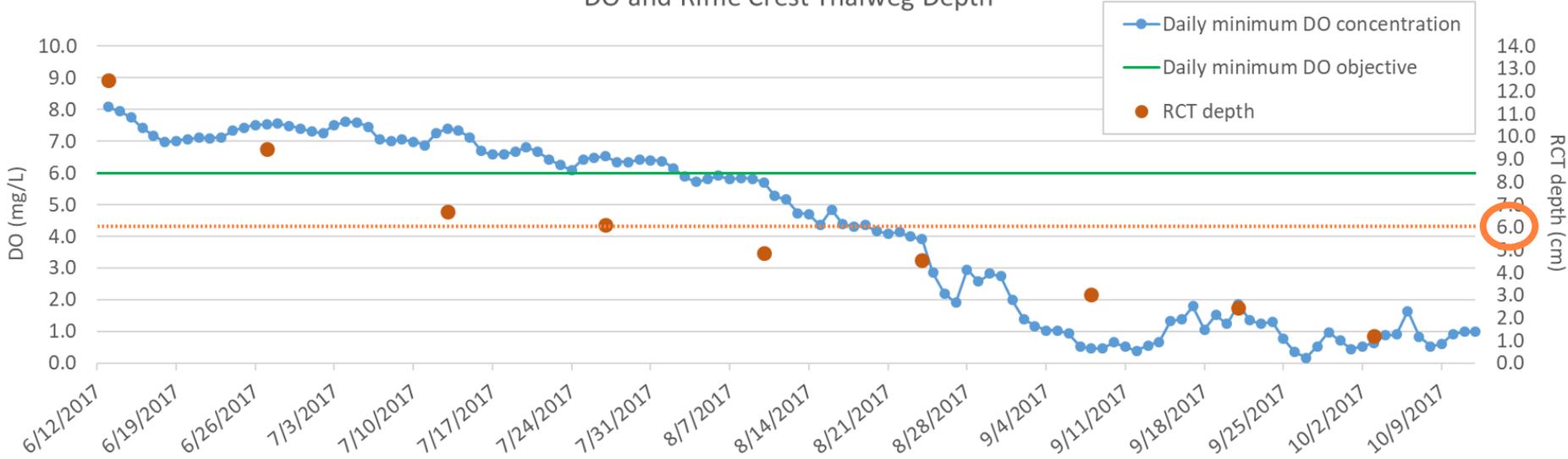
INDUSTRIE 17°C 29.82inHg PS-MIL-P2 08 SEP 2017 09:00 am

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth



DUALTRIE 12°C 29.80inHg PS-MIL-P2 21 SEP 2017 09:00 am

Mill Creek Unit 2 DO and Riffle Crest Thalweg Depth





Next steps

- **Do findings hold true in other watersheds and water years?**
 - Paired down data collection:
 - DO and temperature
 - RCT depth
 - Pool max depth
 - Streambed geology classification
 - Collect data on more coastal CA 2nd-3rd order streams
 - Practical applications
 - Support development of meaningful management criteria protective of ecosystem functions
-

Science Management

Approaches to using Riffle Crest Thalweg (RCT) thresholds to set DO-based flow criteria:

- Establish a relationship of flow to RCT depth to determine bypass flows corresponding with RCT threshold
- Relate RCT depths to flow at an index gage for real-time management
- Site-specific relationship of RCT threshold to stage at individual diversions
- Validate other approaches
- Assessment criteria





Implementation mechanisms

Implement bypass flows, curtailments, and other tools as part of:

- TMDL action plan
- Regionwide threshold - DO objective implementation plan
- Water Rights Policy
- Lake and Streambed Alteration Agreements
- Restoration program

Voluntary Flow Agreements

- Watersheds:
 - Russian Shasta
 - Navarro
 - Mattole
- Dedication, augmentation, and forbearance
- Regional Water Board support:
 - Permitting, where necessary
 - Monitoring
 - Technical input, review
 - Letters of support

David Hines, CDFW



Coho Flow Initiative*

A watershed scale approach to instream flow issues
based on conservation priorities

David Hines

Coho Salmon Recovery Coordinator

California Department of Fish and Wildlife,
Bay/Delta Region, Fisheries Division

* The CFI program is still in development.

Introduction

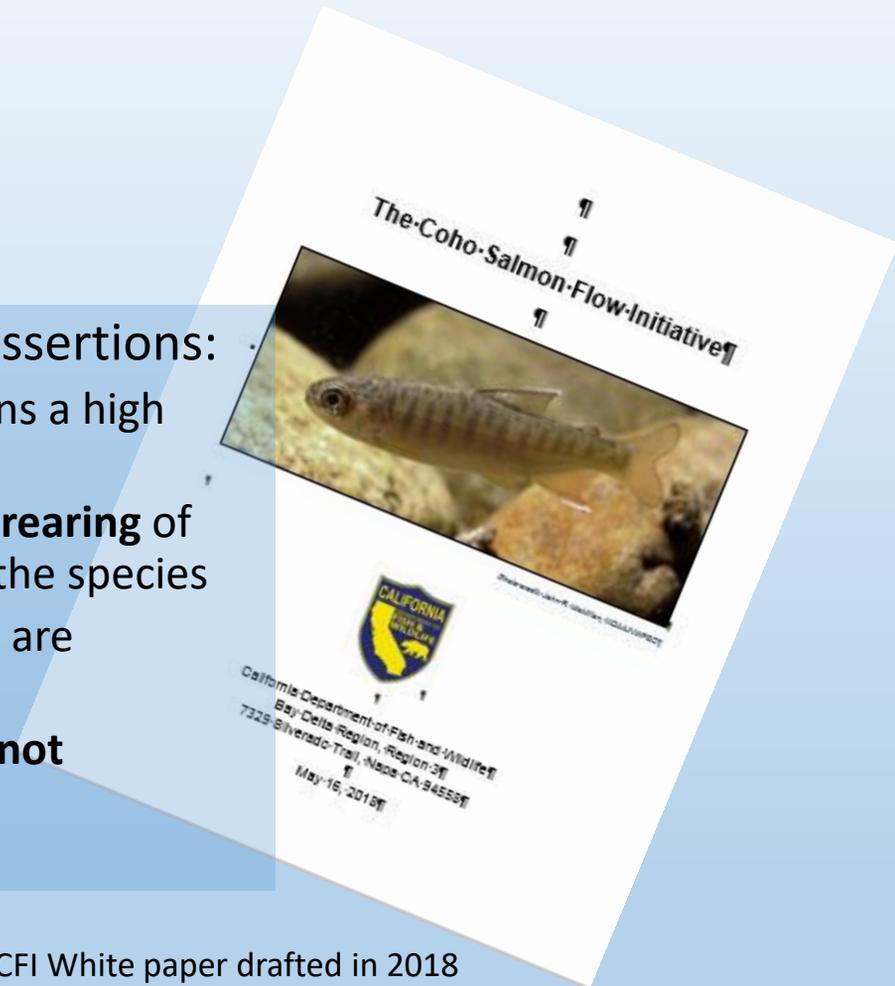
- Problem Statement
 - Conservation Priority
 - Flow Ecology
 - Policy Context
 - Water Demand
- Existing Policies and Management Actions
- Proposal
 - Planning
 - Action
 - Benefits



CFI Problem Statement

- The CFI is framed around these four assertions:
 - The conservation of **coho salmon** remains a high priority for CDFW
 - Lack of stream flow to support **summer rearing** of juveniles is a primary limiting factor for the species
 - **Summer flow** in CCC Coho rearing areas are impaired by current water demand
 - Existing water management **policies do not adequately regulate** water demand

CFI White paper drafted in 2018



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CFI White paper drafted in 2018



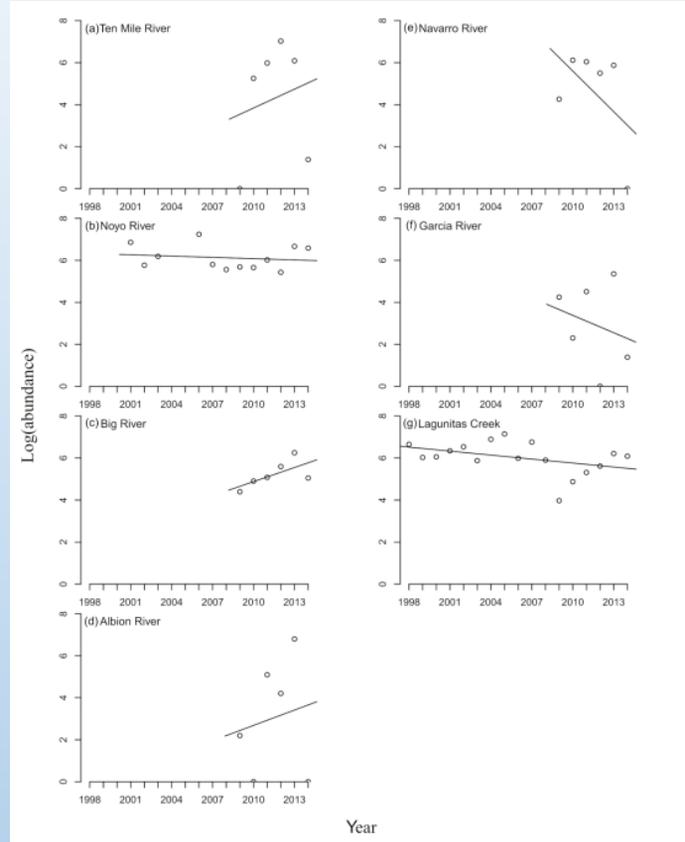


Figure 4.2. Population trends (log abundance) for independent populations of CCC-Coho Salmon. Values for Lagunitas Creek are based on two times the total redd count for the watershed. All other estimates are based on fish/redd expansions from life-cycle monitoring stations.

CFI Problem Statement

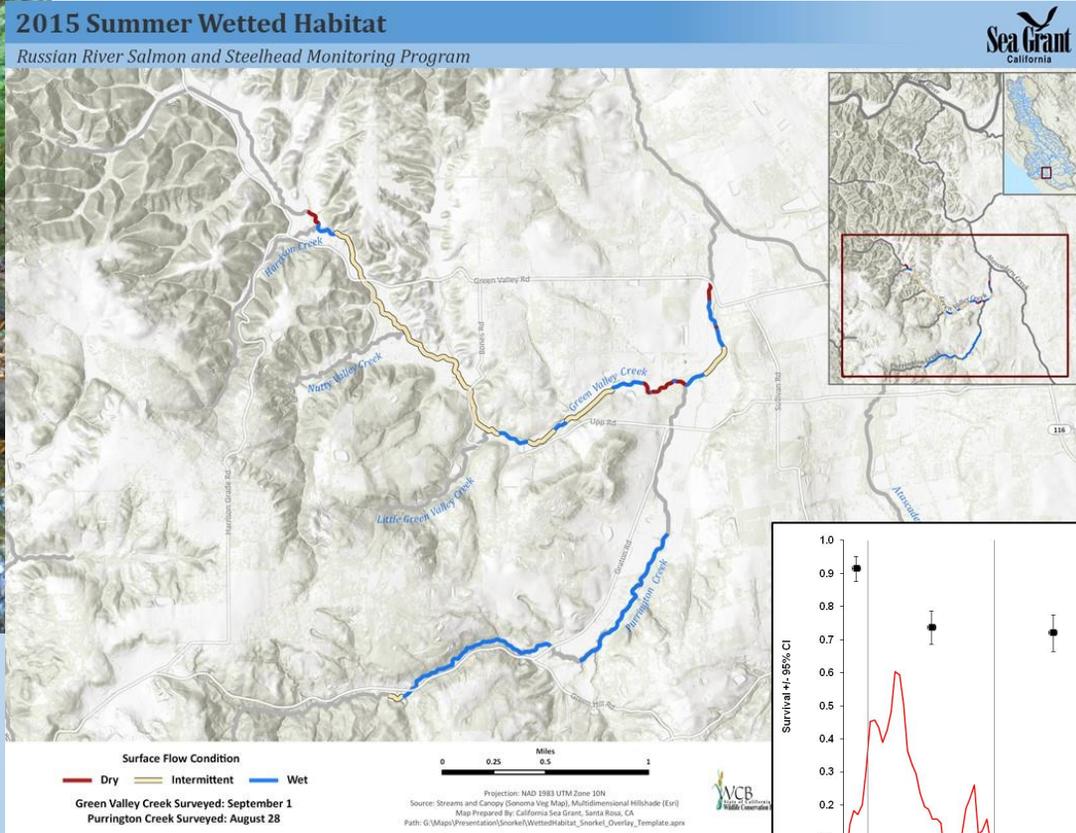
- The CFI is framed around these four assertions:
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 - **Lack of stream flow to support summer rearing of juveniles is a primary limiting factor for the species**
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CFI White paper drafted in 2018

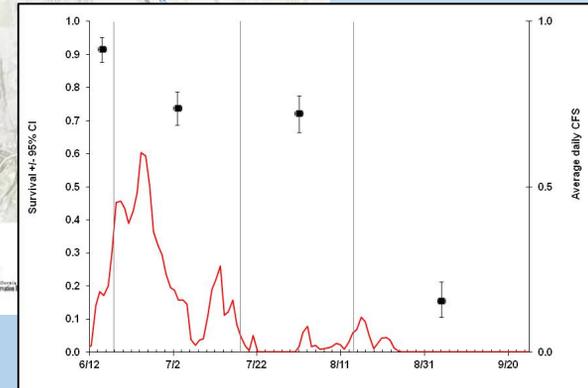




Green Valley Creek



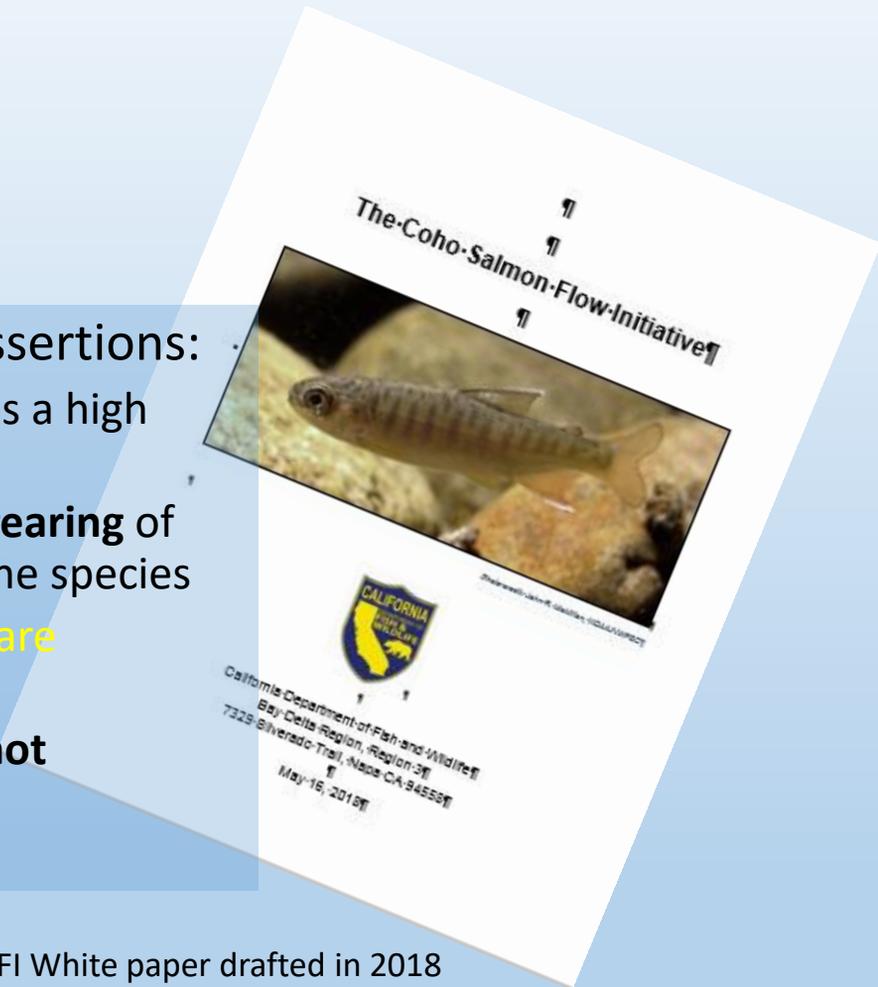
Green Valley Creek



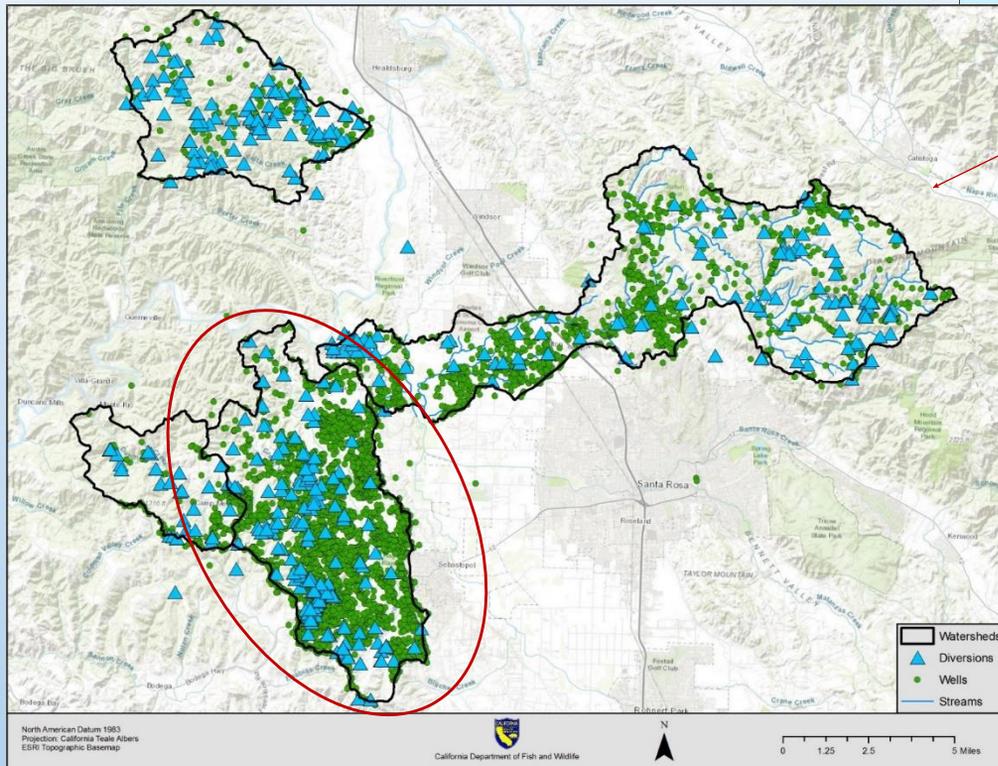
Grape Creek, Obedzinski et al. 2017

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CFI White paper drafted in 2018



SWRCB Information Order Data



CFI Problem Statement

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 - **Summer flow** in CCC Coho rearing areas are impaired by current water demand
 - Existing water management policies do not adequately regulate water demand

CFI White paper drafted in 2018



Existing Policies and Management Actions

- Policies

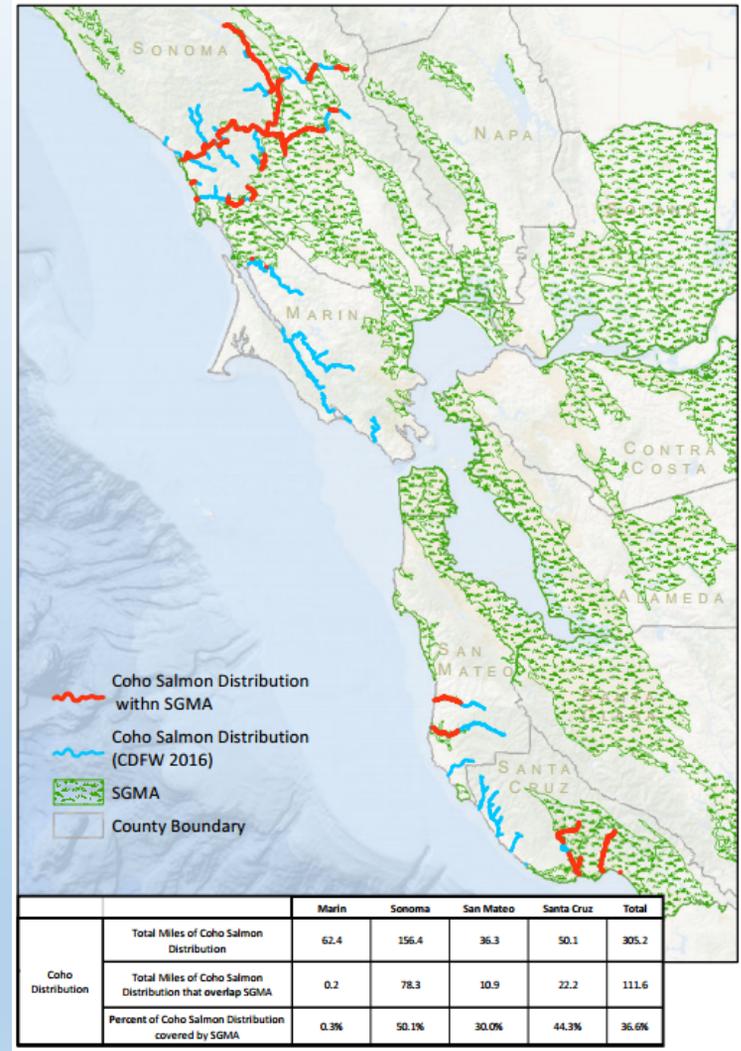
- Appropriative Water Rights - North Coast Instream Flow Policy
- Riparian Rights
- Reasonable Use Doctrine – Emergency Drought Regulation, Frost Regulation
- Sustainable Groundwater Management Act
- North Coast Regional Water Quality Control Board, Basin Planning process
- California Water Action Plan
- Lake and Streambed Alteration Agreements

- Management Actions

- Captive Broodstock Program
- California Environmental Flows Framework
- Streamflow Improvement Plan
- Voluntary storage and forbearance using Restoration Funds
- Flow augmentation projects

Regulatory Gap

- Case in point: Green Valley Creek
 - 93% of all the diversions reported in the critical rearing reach were from wells
- The Sustainable Groundwater Management Act (SGMA)
 - Applies only to Bulletin 118 boundaries
 - Approximately 63% of occupied coho salmon stream miles in R3 lie outside SGMA jurisdiction.
 - Only Medium and High priority basins are subject to full regulation
 - Only 24% of PACT coho streams overlap with Medium or High priority basins
 - Green Valley Creek is a “Very Low” priority



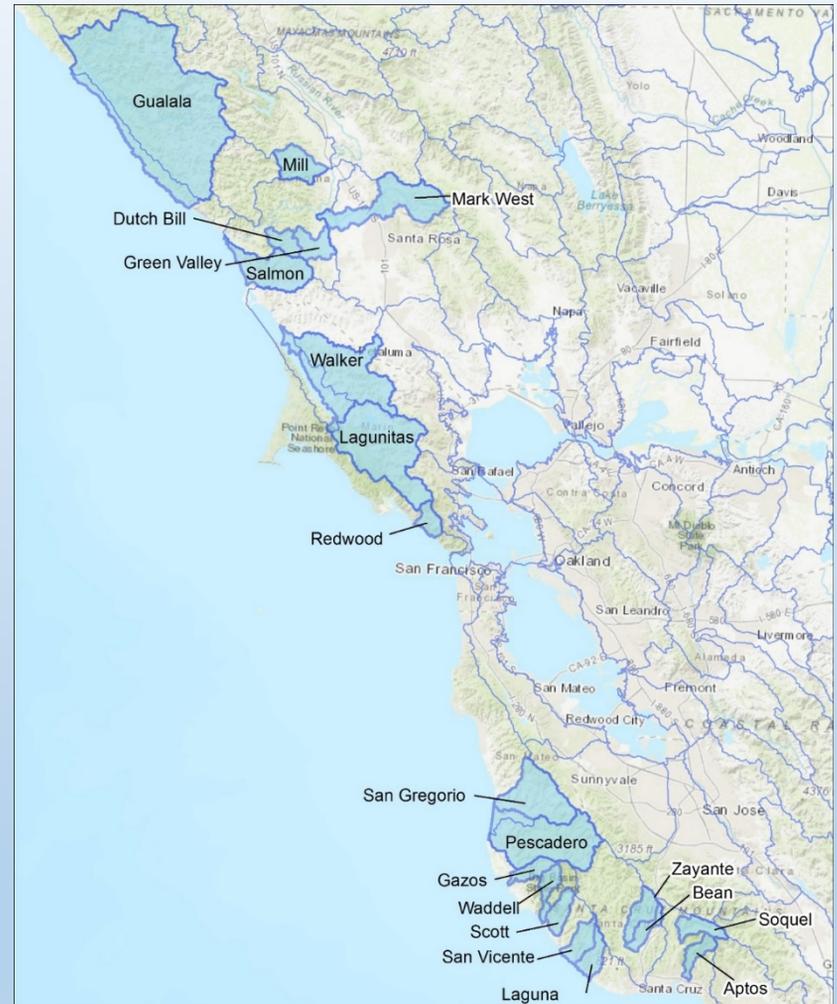
CFI Proposal

- Planning
 - Establishing a conservation target
 - Spatial prioritization
- Actions
 - Developing partnerships
 - Water resource assessment
 - Strategies to reduce water demand
 - Monitoring
- Benefits



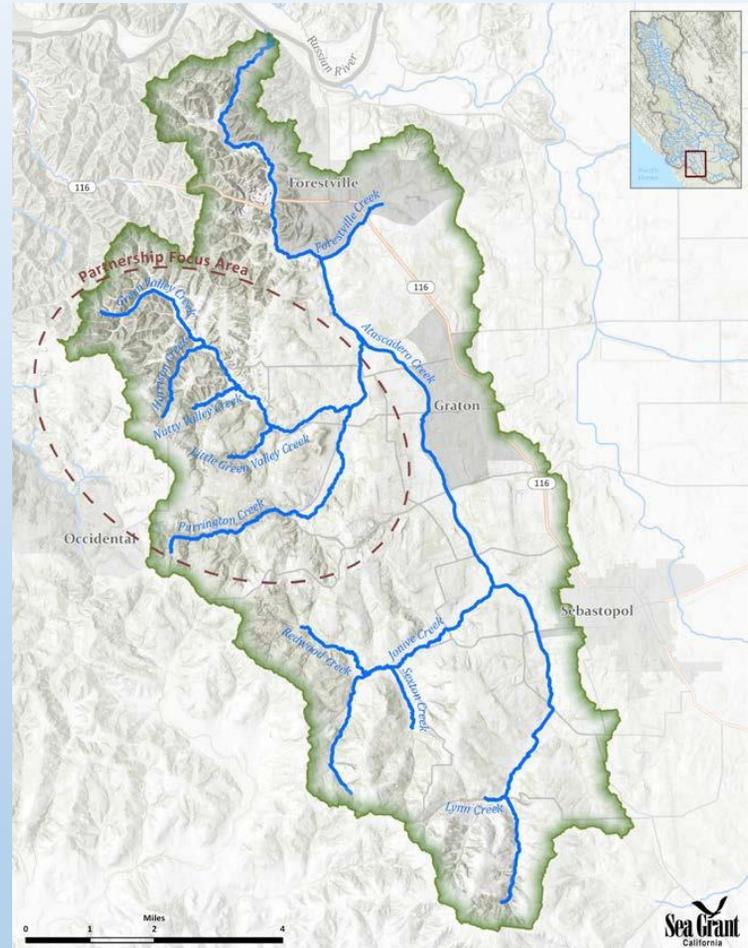
Proposal: Planning

- Conservation target: coho salmon
 - Endangered status
 - Umbrella species for aquatic ecosystems
- Spatial prioritization (to focus limited agency resources)
 - Watershed scale
 - Discrete hydrologic unit
 - Generally correlate with coho salmon populations
- 21 high priority watersheds identified by PACT
 - Hydrologically impaired from water diversions
 - Foci to prevent extirpation of coho salmon
- Russian River
 - Historically the largest population in the ESU
 - Therefore strategically important to recovery
 - Four focus tributaries for hatchery intervention:
 - Green Valley Creek,
 - Mill Creek
 - Dutch Bill Creek
 - Grape Creek



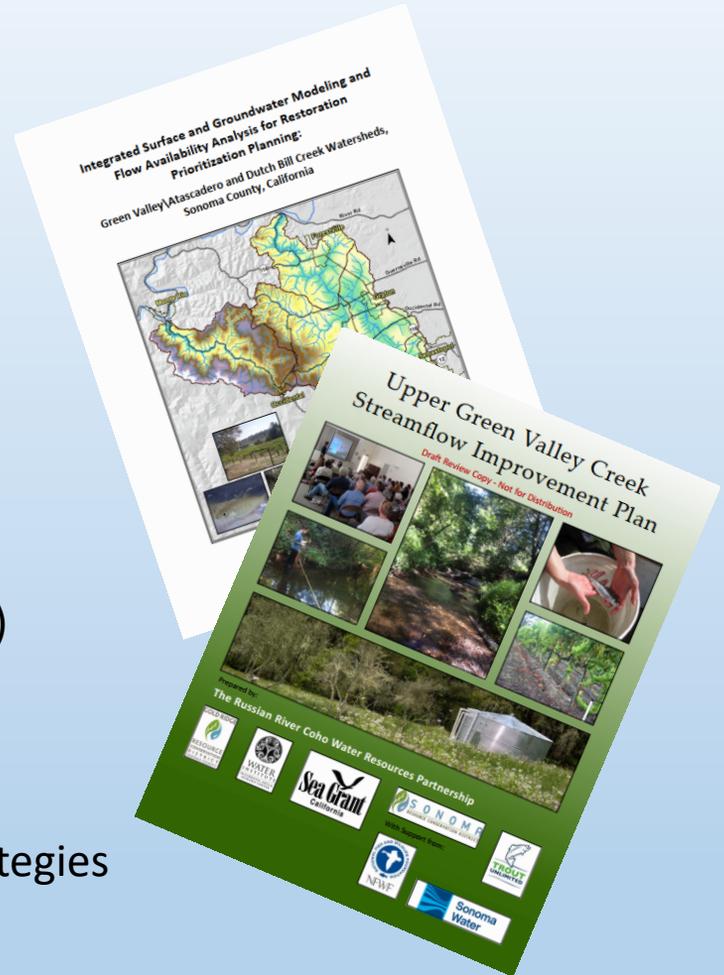
Green Valley Creek

- Suggested pilot watershed for CFI
 - Critical rearing reach in particular
- GVC was the last RR tributary to support 3 consecutive year classes
- Currently produces largest smolts
- Evidence of hydrologic impairment
- High density of water diversions



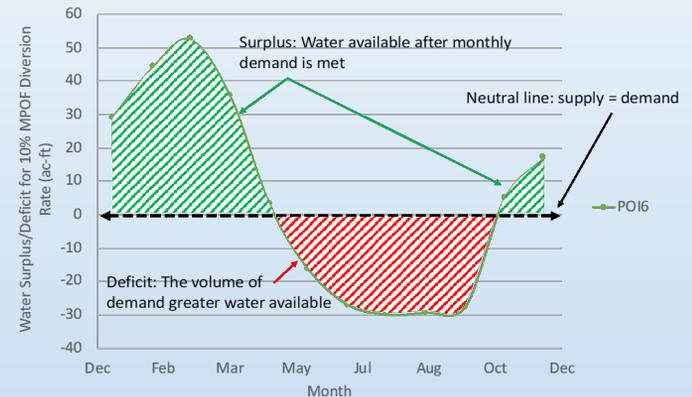
Proposal: Actions I

- Develop partnerships
 - Government agencies
 - Agricultural stakeholders and organizations
 - Non-governmental organizations
- Water resource assessment
 - Evaluate water supply (unimpaired hydrology)
 - Define flow/habitat relationships
 - California Environmental Flows Framework?
 - Assessment of water demands
 - Technical foundation for water allocation strategies



Proposal: Actions II

- Reducing water demand
 - Goal: Where necessary, bring demand in line with supply so there are no stream flow deficits in the summer months
 - Methods to be defined through collaborative process with stakeholders
 - Water conservation strategies may include:
 - Water conservation via infrastructure upgrades
 - Voluntary storage and forbearance agreements, supplemented with restoration funds and streamlined permitting
 - Improved compliance with existing permit terms
 - Permitting or enforcement action on currently unpermitted diversions



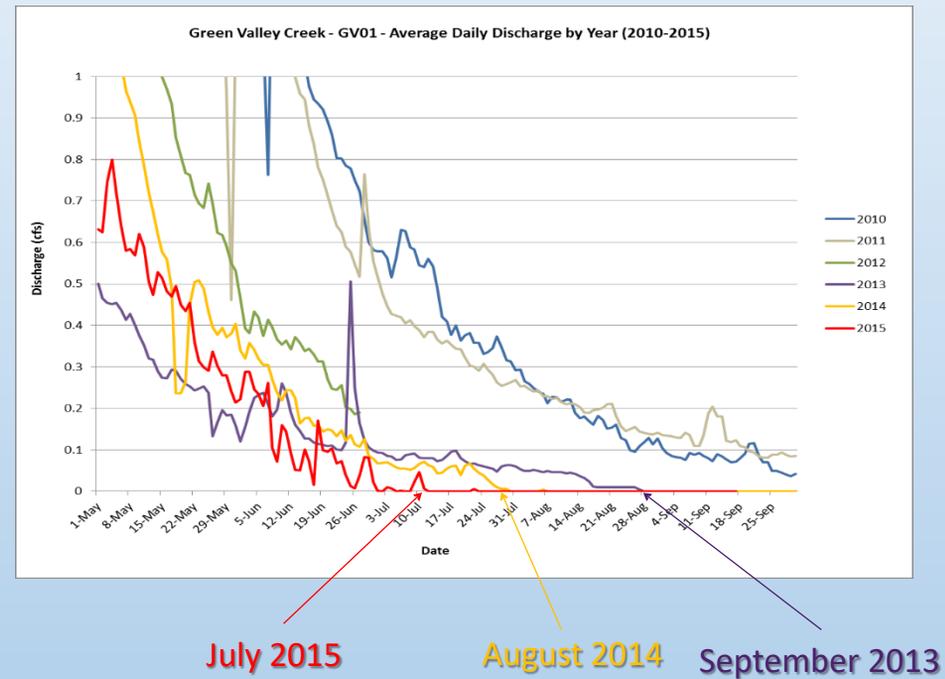
Water demand analysis, Pescadero Creek, J. Carah, TNC



Water storage tanks, Alliance Redwoods, Camp Meeker, CA

Proposal: Actions III

- Monitoring
 - Stream flow in juvenile coho salmon rearing reaches
 - To determine whether sufficient flows are achieved
 - Cost sharing among stakeholders may be necessary
 - Can inform whether additional conservation measures are needed



CFI Benefits

- Improves water security for water users
- Increases effectiveness of conservation efforts
 - By focusing on critical areas in high priority systems
 - By addressing the cumulative effects of all diversions in a watershed
- Minimizes controversy by emphasizing voluntary solutions
 - Regulatory options used only if voluntary actions are not sufficient
- Actions are fair and reasonable
 - Based on a strong technical foundation
 - Limited to only those needed to achieve coho salmon recovery

In Closing:

- The CFI program is still in a formative stage
- We are seeking feedback and suggestions on the proposal
- Looking to develop partnerships
- And attempting to enhance coordination and integrate with existing efforts
- Acknowledgments



References

- CDFW (California Department of Fish and Wildlife). 2018. Coho Salmon Flow Initiative. Internal draft report prepared by Bay/Delta Region staff, Santa Rosa, California.
- California Environmental Flows Framework: <https://ceff.ucdavis.edu/>
- Obedzinski, M., N. Bauer, A. Bartshire, A. McClary, S. Nossaman and P. Olin. 2017. *Recovery monitoring of endangered coho salmon in the Russian River: final report for project NA110AR4170202*. California Sea Grant and University of California Cooperative Extension, Santa Rosa, California.
- OEI (O'Connor Environmental, Inc.). 2016. *Integrated surface and groundwater modeling and flow availability analysis for restoration prioritization planning: Green Valley/Atascadero and Dutch Bill Creek watersheds, Sonoma County, California*. Report prepared for Gold Ridge Resource Conservation District, Occidental, California.
- Robbins, K., M. Obedzinski, J. Green, B. Dolman, M.A. King. In Preparation. Upper Green Valley Creek Streamflow Improvement Plan. Prepared by the Russian River Coho Water Resources Partnership with funding by the National Fish and Wildlife Foundation, Sebastopol, California.
- Spence, B.C. 2016. North-Central California Coast Recovery Domain. Pages 32–82 in T.H. Williams, B.C. Spence, D.A. Boughton, R.C. Johnson, L.G. Crozier, N.J. Mantua, M.R. O'Farrell, and S.T. Lindley. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-564.

Interagency Coordination

- Cannabis, Salmon, and Flow ad hoc workgroup
 - Recent focus on near-stream wells and groundwater- surface water interaction
- Interagency Instream Flow Coordination meeting
 - Statewide information clearinghouse
- California Environmental Flows Workgroup
- CWAP coordination calls
- Technical advisory committees

Water Quality Monitoring Council

California Environmental Flows Workgroup

- Mission: *Advance the science of ecological flows assessment and its application for supporting management decisions aimed at balancing natural resource needs with consumptive water uses to establish environmental flows*
- Meets Quarterly – November, February, May, and August on 2nd Tuesday of Month from 9:00 - 3:30
- Co-Chairs:
 - Dan Schultz, State Water Board – Water Rights
Email: Daniel.Schultz@waterboards.ca.gov
 - Robert Holmes, CA Department of Fish and Wildlife –
Email: Robert.Holmes@wildlife.ca.gov

California Env. Flows Workgroup

Products/Effort

- Guidance for environmental flow criteria
- Appropriate application of tools, databases and models
- Prioritize knowledge gaps that should be funded
- Communication, interpretation, and information on management approaches
- Ways to reconcile technical approaches used by different programs

Current Members

- State Water Board - Water Quality
- State Water Board - Water Rights
- Regional Water Quality Control Boards
- Department of Water Resources
- California Department of Fish and Wildlife
- US Fish and Wildlife Service
- US Forest Service
- US Geological Survey
- Bureau of Reclamation
- NOAA Fisheries

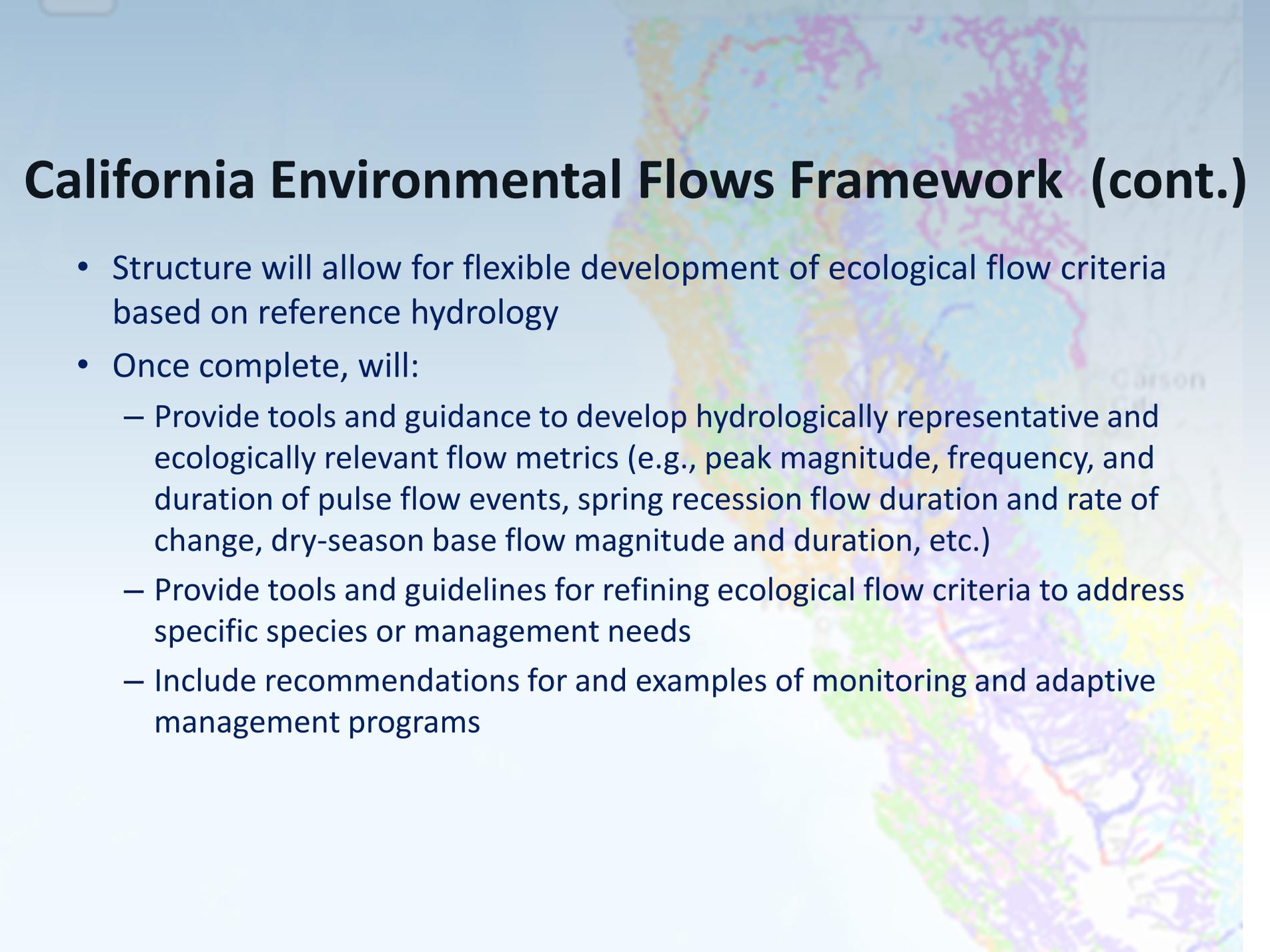
California Environmental Flows Framework

Overview

- Framework for organizing information, methods and analyses, and providing consistent science-based recommendations to inform development of ecological flow criteria
- Based on a functional flows approach that considers all aspects of the annual hydrograph and associated ecological functions
- Funded by State Water Board through contract with UC Davis
- Anticipate peer review and final documents will be completed by Spring 2020



California Environmental Flows Framework (cont.)



- Structure will allow for flexible development of ecological flow criteria based on reference hydrology
- Once complete, will:
 - Provide tools and guidance to develop hydrologically representative and ecologically relevant flow metrics (e.g., peak magnitude, frequency, and duration of pulse flow events, spring recession flow duration and rate of change, dry-season base flow magnitude and duration, etc.)
 - Provide tools and guidelines for refining ecological flow criteria to address specific species or management needs
 - Include recommendations for and examples of monitoring and adaptive management programs

California Environmental Flows Framework (cont.)



Potential regional applications:

- “Functional flow” estimates provide objective benchmarks to compare observed conditions against
- Potential for use in basin planning context as a basis for ranking and prioritizing needs and efforts
- Faster path to numeric criteria, potentially

Wrap-Up

Staff recommendations

Continue pursuing:

- Numeric flow criteria in the Navarro, in collaboration with SWRCB and CDFW
- Narrative flow objective approaches
- Tools for addressing low flows:
 - Flow-water quality relationships
 - California Water Action Plan efforts
 - Voluntary flow agreements and augmentation

What can the Regional Board expect to consider?

- Navarro flow objective
- Narrative flow objective
- Support for voluntary flow efforts

Questions?